

## DETAILED ACTION

### *Drawings*

1. The drawings are objected to because of the following:
  - a. The labels are handwritten. To promote clarity in duplication, provide machine-written labels.
  - b. Fig. 1 is not labeled as such.
  - c. Fig. 1 is missing radiation 10, reflected radiation 11, and transmitted radiation 12 as described on p11 of the specification.
  - d. Fig. 2A is missing labels for parts 1a, 2 and 5 as described on p13.
  - e. Fig. 2E is labeled 2F.
2. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner,

the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Objections***

1. Claims 8, 20 and 21 objected to because of the following informalities:
  - a. Claim 8 describes a diffraction "gating." The examiner interprets this to mean diffraction "grating."
  - b. Claims 20 and 21 are exactly the same claim.
2. Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

3. Claims 1-40 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.
4. Claims 1, 23, and their respective dependents, describe a pigment comprising an inner diffractive structure "surrounded by an epitaxially applied sealant material." The specification, however, does not disclose which definition of epitaxy is meant. As shown by Peterman, there are two definitions for epitaxy. "Classical epitaxy" is the oriented overgrowth of a layer material onto a structure surface of a solid substrate, wherein the structurization (sic) is a matching of the crystallographic surface planes of the substrate

and layer. "Graphoepitaxy," meanwhile, is oriented overgrowth of a layer material onto a structure surface of a solid substrate, wherein the structurization (sic) is a matching of a surface topology of the substrate in a nanometer range influencing nucleation and growth of the layer material. Under classical epitaxy the sealant material would take on the crystal lattice structure of the substrate. Graphoepitaxy, however, implies that the sealant material simply follows the topology, e.g. the rises and depressions, of the diffraction grating. One of ordinary skill in the art, would not be able to ascertain which definition is used for this invention from Applicant's disclosure. For the purposes of this Office Action, the examiner interprets "an epitaxially applied sealant material" to describe graphoepitaxy, i.e. one which forms a nanometer-scale layer around the diffraction grating.

5. Additionally, if Applicant intends for the application of material to fall under classical epitaxy, there arises a further issue:

6. Claims 1-40 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a pigment with the described surface area with a defined diffractive structure, does not reasonably provide enablement for "an epitaxially applied sealant material". The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims. In classical epitaxy the identities of the substrate and the applied layer are necessary for the process to work; the substrate is the seed crystal to which the applied layer begins to crystallize. As such, the substrate must be able to provide a lattice structure that the material composing the

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applied layer may correspond to. Furthermore, both metals and polymers may be applied epitaxially, but they have different methods of formation, and within each group, specific species require different conditions from other species. As such, one of ordinary skill in the art could not make or use the claimed invention.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 3, 16, 19, 22, 23, 25, 29, 31, 32, 35, 37, 39 are rejected under 35

U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

9. The term "platelet-like" in claim 3 is a relative term which renders the claim indefinite. The term "platelet-like" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The examiner considers the addition of "like" to be equivalent to adding the term "type" and thus makes the claim indefinite. The word platelet is already a broad term describing an amorphous flat object, so it is unclear what can be "platelet-like" without being simply a platelet.

10. Claims 16, 19, and 22 recite the limitation "platelet level" in line two, line two, and both lines two and three, respectively. There is insufficient antecedent basis for this limitation in the claim. Furthermore, there is no indication in either the specification of the claims to determine what is meant by platelet level. In claim 16 it appears to refer to

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platelet size. In claims 19 and 22 it appears to refer to the layers comprising the platelet. The examiner interprets the term in these two ways for the purposes of this Office Action.

11. The term "foil-like" in claim 23 is a relative term which renders the claim indefinite. The term "foil-like" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The examiner considers the addition of "like" to be equivalent to adding the term "type" and thus makes the claim indefinite.

12. The terms "relatively elastic" and "brittle" in claim 31 are relative terms which render the claim indefinite. The terms "relatively elastic" and "brittle" are not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unclear what Applicant considers to be elastic or brittle. Further, it is unclear whether the elasticity is merely relative to a brittle material.

13. The term "brittle" in claim 32 is a relative term which renders the claim indefinite. The term "brittle" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unclear how inelastic something must be for it to be considered brittle by Applicant.

14. The terms "lacquer-like" and "resin-like" in claim 32 are relative terms which render the claim indefinite. The terms "lacquer-like" and "resin-like" are not defined by

the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The examiner considers the addition of "like" to be equivalent to adding the term "type" and thus makes the claim indefinite.

15. The term "auxiliary agent" in claim 35 renders the claim indefinite. The term "auxiliary agent" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The guidance from the specification is only that a wetting agent is an "auxiliary agent." The examiner interprets any coating to the pigment to be an "auxiliary agent."

16. The term "print color" in claims 37 and 40 renders the claims indefinite. The term "print color" is not defined by the claim or the specification. The normal meaning of "print color" is the "color of a print or ink," but Applicant appears to be using the term to describe something similar to an ink. It renders the claims indefinite because it appears to be something other than ink (see the use in claim 40). For the purpose of this Office Action, the examiner interprets it to be equivalent to ink.

17. The abbreviations in claim 39 render the claim indefinite. The abbreviations are not defined by the specification, and are only referred to by said abbreviations therein. It is unclear exactly which polymers Applicant refers to.

18. Regarding claims 16, 25, 29 and 39: A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the

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metes and bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949).

19. In the present instance:

- Claim 16 recites the broad recitation "between 5 pm and 200 pm", and the claim also recites "especially in the range between 10 pm and 30 pm" which is the narrower statement of the range/limitation.
- Claim 25 recites the broad recitation "carried out by lithography", and the claim also recites "specifically by electron radiation or optical lithography" which is the narrower statement of the range/limitation.
- Claim 29 recites the broad recitation "carried out by vaporizing", and the claim also recites "in particular, with metallic fumes" which is the narrower statement of the range/limitation.
- Claim 39 recites the broad recitation "transparent plastic", and the claim also recites "specifically PET, PEN, PST, PA, PC" which is the narrower statement of the range/limitation.

***Claim Rejections - 35 USC § 102***

20. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

21. Claims 1, 3-5, 12-19, 23, 24, 27, 28, and 31-34 are rejected under 35

U.S.C. 102(b) as being anticipated by Josephy et al. (6398999).

22. Regarding claims 1, 3, 4, and 18:

Josephy et al. (herein Josephy) disclose flakes that may be used in inks or paints, i.e. pigments (col 1 In 19-21). The flakes may be embossed with a holographic or diffraction grating pattern (col 10 In 42-45). Other layers will share this pattern (col 10 In 46-48). The examiner considers flakes to be platelet-like shaped, and notes that on one side of the flake structure a surface area that is the entire surface area for that side exists.

Josephy discloses examples wherein flake size of 3 by 2 microns are produced (col 11 In 43). 2 microns is equivalent to 2000nm, and thus is a measurement greater than a multiple of 400nm.

The flakes can have different multi-layer embodiments, including (2) release/ protective layer/metal/protective layer/release (col 7 In 11). The two protective layers are interpreted to be Applicant's sealant material. The protective layer, as well as others, may be applied by EB (electron beam) deposition to



grow thin coatings (col 6 In 19-23). See the above **Claim Rejections - 35 USC § 112** for clarification of “epitaxially applied.”

One of ordinary skill in the art would clearly envisage a periodic diffractive structure with a defined spatial frequency and spatial alignment from the use of “diffraction grating” by Josephy (col 10 In 42-45).

23. Regarding claims 12-15:

Josephy teaches that the protective layer forms a hard clear coat (col 5 In 52). The term “clear” denotes an optically permeable substance.

Since Josephy teaches that the flakes may be “embossed” with a diffraction grating, such a grating would necessarily be defined by the thickness of the flake (or pigment), i.e. the grooves would be a result of rises and depressions in the material.

Metal coatings are provided, including those of aluminum, copper, silver-all reflective materials (col 5 In 64). Furthermore, reflection enhancing stacks (layers of highly reflective materials) may be used (col 5 In 66+). The reflective metal layers would take on the diffractive grating structure (col 10 In 45).

24. Regarding claims 16 and 17:

One embodiment produces aluminum flakes about 4x12 microns in size (col 9 In 39). Josephy also discloses that it is possible to create aluminum flakes having a thickness from 0.1-2.0 microns (col 1 In 37). By disclosing this, Josephy shows that producing flakes with a thickness between 0.1-2.0 microns is not beyond one of ordinary skill level, and processes do exist to allow one to vary the

thickness of the flakes depending on one's needs. As such, one of ordinary skill in the art would clearly envisage varying the thickness of the flake.

25. Regarding claims 5 and 19:

The embossing process would necessarily create a diffraction grating on both sides of a given flake, i.e. each side (area) would have a divergent periodic diffractive structure.

26. Regarding claims 23, 24, 27 and 28:

To create the flakes as described, the carrier is embossed (stamped) with a diffraction grating, the subsequently applied layers replicate the grating pattern (col 10 ln 42-48). The examiner considers this to be equivalent to "reaction embossing". Also, it is well known in the art to apply heat during embossment (hot stamping) to make a better impression. The multi-layer sheet may then be ground (pulverized) into flakes (Fig. 5; col 3 ln 4). One of the layers may be reflective, as described previously.

The electron beam deposition described above is a form of vapor deposition.

27. Regarding claims 31, 32 and 33:

The carrier layer may be a relatively elastic polyester such as polyethylene terephthalate (PET) (col 2 ln 36). A protective layer such as silicon dioxide (col 9 ln 49), is more brittle than PET. The examiner considers the glass-like coating (col 9 ln 60) to be equivalent to a lacquer- or resin-like coating. After grinding, the flakes can be air-milled (trimmed) to reduce particle size (col 3 ln 4).

Josephy teaches that aluminum flakes can be made using ball milling, wherein the flakes are in a slurry-a mixture of solid and liquids, i.e. they can be made by wet pulverization (col 1 ln 28-30).

28. Regarding claim 34:

The inks and paints that use the described invention, would inherently be made of a pigment powder of the described flakes (col 1 ln 19-21).

***Claim Rejections - 35 USC § 103***

29. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

30. Claims 20-22, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Josephy et al. (6398999).

31. Applicant claims a pigment wherein sealant comprises a hydrophobic substance in claims 20 and 21. Applicant claims a pigment wherein the first side of the pigment comprises a hydrophobic substance, and the other side comprises a hydrophilic substance in claim 22. Applicant claims the sealant substance is applied with metallic fumes in claim 29. The foil-like medium is snipped in claim 30.

32. Josephy et al. (herein Josephy) disclose aluminum flakes having a diffractive structure as described previously. The protective coating is an inert, insoluble inorganic material (col 5 ln 51). Furthermore, the flakes can be made moisture-resistant by the

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outer protective coat (col 10 ln 2). Also, silicon dioxide, a hydrophilic material, can comprise the protective coating (col 9 ln 49).

33. Josephy is silent, however, with regard to using a hydrophobic layer, making one layer hydrophobic and the other hydrophilic, using metallic fumes to apply the sealant substance, and snipping the foil.

34. Regarding claims 20-22:

One of ordinary skill in the art would recognize that a hydrophobic substance would provide a moisture-resistant protective coating; it inherently repels water. One of ordinary skill would also recognize the two protective coatings (one on each side) come from two independent sources (Fig. 2, 46, 50; col 4 ln 40). If only one side needed to be moisture resistant, then one could simply use a hydrophobic substance in one source, and a hydrophilic substance like silicon dioxide in the other.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to make use of a hydrophobic substance to improve moisture resistance, and also use two different materials for each protective coating, one being hydrophobic, the other being hydrophilic.

35. Regarding claim 29:

One of ordinary skill would recognize that metal would be an acceptable protective material, as it is inert, insoluble and inorganic. Josephy teaches one can vapor deposit metal layers for the formation of the internal metal layer (col 5 ln 59).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use metal as a protective coating for Josephy's flakes, and apply the metal by vaporizing the metal.

36. Regarding claim 30:

One of ordinary skill in the art would recognize that one could snip the flakes off the original sheet if desired.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to snip the aluminum sheet into flakes.

37. Claims 2, 7, 26, 35-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Josephy et al. (6398999) in view of Miekka et al. (6068691).

38. Applicant claims a pigment having a surface area with the smallest measurement being at least a multiple of 800nm, and comprising a diffractive structure having a spatial periodicity that is at least a multiple of 800nm. The diffraction structure affects both UV and visible light in claim 7. Claim 16 specifies the thickness of the pigment. Claim 26 allows for the diffractive structure to be created by scratching. Claims 35-36 describe a pigment powder having a wetting agent. Claims 38-39 are directed to a print color, a lacquer, and a plastic having said powder. Claim 40 is for a document imprinted with said print color or plastic.

39. Josephy et al. (herein Josephy) disclose aluminum flakes having a diffractive structure as described previously.

40. Josephy is silent, however, with regard to the diffractive structure being used for UV light, the flake thickness claimed, and the ability to create the diffractive structure by scratching. Josephy is also silent with regard to substances containing said powder, and documents containing said substances.

41. Miekka et al. (herein Miekka) disclose embossed metallic flakes useful for security applications (col 3 ln 43). The diffractive structure has between 5,000-11,000 grooves per cm (claims 8, 12). One technique for making diffractive gratings is by scribing lines on a metal surface (col 3 ln 7).

42. Regarding claims 2 and 7:

The smallest measurement of Josephy's flakes are 2,000nm as described previously. This is at least a multiple of 800nm. The diffractive structure described by Miekka would effect both UV and visible light: the groove density (5,000-11,000 grooves per cm) corresponds to a groove period of 909-2,000nm. (Note the groove density is the inverse of groove period.) The groove period must be on the order of the wavelength of light intended to be used with the diffraction pattern. Thus, the grating described could be used for both UV and visible light.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine Josephy's general teaching of creating a diffraction pattern on a metal flake with Miekka's teaching of a flake having the specified groove period to affect both UV and visible light.

43. Regarding claim 26:

Miekka discloses that the early diffraction gratings can be scribed into the metal. Such processes are still available to one of ordinary skill in the art.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to create the diffraction gratings present in Josephy's flakes by scribing (scratching), as shown in Miekka.

44. Regarding claims 35, 36 and 39:

Miekka discloses Example 13 wherein a lacquer comprises the aluminum pigment, an acrylic binder, and a wetting agent (col 10 ln 60+).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use a wetting agent with Josephy's pigment flakes for its use in coatings and to use a plastic binder in said coatings.

45. Regarding claims 37 and 38:

Miekka discloses that the aluminum pigments can be used in printing, lacquer and paints (col 11 ln 5).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use Josephy's flakes in print colors and lacquer.

46. Regarding claim 40:

Miekka teaches that the flakes can be used for security applications (col 3 ln 43).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use Josephy's flakes to create a pigment suitable for use as a holographic security tag for use on a document.

47. Claims 6 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Josephy et al. (6398999) in view of Lee (5912767).

48. Applicant claims a pigment having various areas, each having a diffractive structure that varies in spatial frequency and/or spatial alignment. Claims 8 and 9 describe the diffraction grating as having concentrically circular or concentrically polygonal diffraction lines. Claim 10 describes the diffractive structure as being an overlay of different spatial frequencies and alignments. Claim 11 describes the pigment as being a cutout from a hologram.

49. Josephy discloses metal flakes having holographic or diffractive patterns, as previously described.

50. Josephy is silent, however, with regard to the varying spatial frequencies and alignments and the non-linear diffraction gratings.

51. Lee discloses diffractive indicia with dimensions on the order of 10 microns, for use in inks (col 1 ln 56; col 2 ln 14). The diffractive structure comprises concentric circular grooves, or concentric regular polygonal grooves (col 2 ln 31-34). Depending on the optical properties desired, the spacing between groove can be modulated and/or of different spatial frequencies (col 2 ln 35). The grooves do not need to be continuous (col 4 ln 42). Lee also teaches one can create an optical ("picture-switch") effect by



"overprinting" (overlying) a diffractive pattern onto another diffractive pattern (col 4 ln 24-31).

52. Regarding claims 6, 10 and 11:

At the time of the invention, it would have been obvious to one of ordinary skill in the art to vary the spatial frequencies and alignments of the grooves of Josephy's diffraction gratings to change the optical properties of the flakes. Also, it would have been obvious to overlay one diffractive structure on another to arrive at what Lee calls a "picture-switch effect," and further use this in the hologram of Josephy's flakes.

53. Regarding claims 8 and 9:

At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine Josephy's teaching of metal flakes with Lee's teaching to create concentric diffractive patterns on said flakes to create a desired optical effect.

54. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Josephy et al. (6398999) in view of Kuwayama et al. (50354373).

55. Applicant claims that step (a) of the process in claim 23 is carried out by lithography.

56. Josephy discloses metal flakes having holographic or diffractive patterns, as previously described.

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57. Josephy is silent, however, with regard to creating the diffractive grating by lithography.
58. Kuwayama et al. disclose a diffraction grating created by lithography (col 2 ln 66).
59. At the time of the invention, it would have been obvious to one of ordinary skill in the art to create the diffractive grating used in Josephy's flakes via lithography, as it is well known in the art.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Freeman whose telephone number is 571-270-3469. The examiner can normally be reached on Monday-Friday 7:30-5:00PM EST (First Friday off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, D. Lawrence Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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